

## Effects of pregnancy on olfaction

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### Abstract

In this review, we aimed to report the effects of pregnancy on olfaction function of the women. Since estrogen and progesterone levels change in specific physiological conditions, pregnancy and postmenopausal period exert an effect on the capability to sense and identify smells. Nasal stuffiness increased during pregnancy. 66.6% of the pregnant women were suffering olfactory dysfunction in the second trimester; while 95.8% in the first and third trimesters. Olfactory function was lessened following birth and throughout the first 6–12 weeks; however, it seemed to improve entirely. In pregnant women, olfactory dysfunction was observed in all trimesters; while it was less in the second trimester and high in the first and third trimesters. The smell abnormalities were almost absent at postpartum period. As olfactory functions improved after delivery of the baby, olfactory changes during pregnancy may be accepted as physiological changes which were observed in many pregnant women.

**Keywords:** Olfaction, pregnancy, olfactory dysfunction.

### Özet: Hamileliğin koku alma üzerindeki etkileri

Bu derlemede, gebeliğin kadınların koku alma fonksiyonuna etkilerinin araştırılması amaçlanmıştır. Gebelik ve postmenopozal dönemde, östrojen ve progesteron seviyeleri spesifik fizyolojik koşullarda değiştiğinden, koku algılama ve tanımlama yeteneği üzerinde etkili olmaktadır. Hamilelik sırasında burun tıkanıklığı artmaktadır. Hamilelerin %66.6'sı 2. trimesterde olfaktör bozukluktan rahatsızken; %95.8'i birinci ve üçüncü trimesterde rahatsızdır. Koku alma fonksiyonu doğumdan sonra azalmakta ve ilk 6–12 hafta içinde tamamen düzeldiği görülmektedir. İkinci trimesterde daha az, birinci ve üçüncü trimesterde daha yüksek olmak üzere, hamile kadınlarda tüm trimesterlerde koku alma bozukluğu gözlenmektedir. Postpartum dönemde koku anormallikleri neredeyse tamamen kaybolmaktadır. Koku alma fonksiyonları bebeğin doğumundan sonra iyileştiği için, hamilelik süresince birçok gebede görülen olfaktör değişiklikler fizyolojik değişiklikler olarak kabul edilebilir.

**Anahtar sözcükler:** Gebelik, koku alma, koku alma bozuklukları.

Olfaction is the capability to distinguish and identify smells. The olfactory sense influences management of somatic and visceral functions, and sexual activities associated with the limbic system. Since estrogen and progesterone levels change in specific physical conditions, pregnancy and postmenopausal period exert an effect on the capacity to sense and identify smells. Also, it connects higher cortical functions and the endocrine system.<sup>[1]</sup> Substances must fulfill two requirements for an odor to be perceived. Firstly, it must be volatile at ambient temperature, and secondly, it must be soluble in fat solvents. Once a molecule reaches the receptors located in the upper portion of the superior nasal cavi-

ty, it binds to and depolarizes the olfactory nerve receptors. The bipolar cells are grouped in bundles that infiltrate the ethmoid bone cribriform plate. They form a synapse with the olfactory bulb neurons. From the olfactory bulb, projections of secondary neurons bind to the primitive cortex, hippocampal formation and the pyriform lobe.<sup>[2]</sup>

The smell sense leads to minimum three distinctive mechanisms: (i) odor threshold, (ii) odor discrimination, and (iii) odor identification. Testing of the different components of olfaction as well as threshold assessment postulates the utmost noteworthy method to the identification of smell loss.<sup>[3]</sup>

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## Olfactory Loss

The absence of the sense of smell is called anosmia. Hyposmia refers to diminished sensitivity to smell. Dysosmia refers to a distortion of smell. Phantosmia refers to smell of an odor for which there is no stimulus. Presbyosmia refers to hyposmia associated with aging. Due to gender, smoking status or age, normal individuals may have some degree of olfactory loss. Women's olfactory acuity is higher than men at all ages.<sup>[2]</sup>

The olfactory dysfunction may well be triggered by nasal obstruction or olfactory epithelium inflammation. Management of olfactory loss associated with sinonasal disease is possible with surgical procedures and/or management with antibiotics or steroids. Mostly, enhancement of olfactory function seems to be associated with the anti-inflammatory properties of steroids. It seems possible that minor nasal congestion occurs in pregnancy which is not relevant to nasal airflow. However, it adequately narrows the olfactory cleft to influence olfactory thresholds. This condition is similar to the existence of nasal polyposis.<sup>[4]</sup>

## Assessment of Olfactory Performance

"Sniffin' sticks" is based on pen-like odor-dispensing devices to test nasal chemosensory performance. For repetitive and inexpensive screening of odor identification, this portable test is sufficient. The test includes a forced odor-identification task for seven odor types. Sniffin' sticks may be useful in the standard clinical evaluation of olfactory function.<sup>[5]</sup>

## Nose and Pregnancy

### Nasal symptoms in pregnancy

The incidence of nasal obstruction improved during pregnancy. It occurred in 27% of the pregnant women at 12 weeks of gestation, in 37% at 20 weeks of gestation, in 40% at 30 weeks of gestation, and in 42% at 36 weeks of gestation. It was common in multiparous women. Self-reported nasal obstruction for three or more weeks was frequent during pregnancy in two-thirds of the women.<sup>[6]</sup>

Pregnant women manifest an odor intolerance compared to non-pregnant women. It disturbs their everyday actions, with mainly sensory/somatic symptoms. Embryo and maternal protective functions may affect this behavior.<sup>[7]</sup>

Significant fluctuations were also noted for body temperature, nasal airflow across the cycle phases of the women with normal cycling for all the hormones examined. Fluctuations reported in some sensory systems dur-

ing the menstrual cycle.<sup>[8]</sup> Increasing levels of beta-estradiol that occur in vitro fertilization treatment cause no significant effect on nasal physiology.<sup>[9]</sup> The menstrual cycle does not significantly influence olfactory sensitivity.<sup>[10]</sup>

### Nausea-vomiting and olfaction

Though the trigger of nausea and vomiting during pregnancy is not identified, there is convincing evidence relating to estrogens or human chorionic gonadotropin.<sup>[11]</sup> Olfaction is a well-known cause for nausea and vomiting during pregnancy.<sup>[12]</sup> The exact etiology of hyperemesis gravidarum is unidentified, but hyperolfaction may be a causative feature. Hyperolfaction in pregnancy may cause the pregnant woman to search for a fresher, noiseless, and comfortable environment.<sup>[13]</sup>

## The Effects of Pregnancy to Olfaction

66.6% of the pregnant women were suffering olfactory dysfunction in the second trimester; while 95.8% in the first and third trimesters. Of the schizophrenics, 81% were dominated by partial anosmia. Moreover, 5% of the patients in this condition either exhibited parosmia or phantosmia.<sup>[14]</sup>

Variations in the discernment of odors in pregnancy are a renowned phenomenon. Researchers have reported a general improvement in sensitivity. The highest impact diverges from the first trimester to the second and third trimesters.<sup>[15]</sup> Other investigators revealed reduced sensitivity in late pregnancy. The variations in olfactory sensation were examined in pregnant women during each trimester of pregnancy, in non-pregnant women and in women between postpartum 2 and 3 months. The differences in odor evaluation were greatest in the third trimester. Olfactory function was evaluated through each trimester of pregnancy and postpartum. In this report, no constant variances in olfactory sensitivity were revealed between two groups.<sup>[15]</sup>

Kuga et al. revealed that non-pregnant women had lower gustatory thresholds than pregnant women. Apparent reduction in the gustatory function was observed in the first trimester of pregnancy. During the first trimester, gustatory sense is reduced and the reduction is considered to be due to the hormonal changes in pregnancy.<sup>[16]</sup>

It is hypothesized that olfactory function is decreased obviously after birth and postpartum 6–12 weeks; however, it appears to be improved totally. Although pregnancy is characteristically along with variations in olfactory show, olfaction does not diminish as a function of the number of pregnancies.<sup>[17]</sup>

Zwaardemaker stated that, especially in the first trimester, pregnancy is related with hyperacuity.<sup>[18]</sup> Early pregnancy can be associated with a bizarre sense of smell instead of hyperosmia. The misperception of certain odors during early pregnancy was revealed.<sup>[19]</sup>

Savović et al. reported that all variations of the olfactory sense in pregnancy are clarified by mental fluctuations of pregnant women. The reduction of olfactory capacity in postmenopause is described by the weakening sexual hormone levels.<sup>[1]</sup> In another study, 31 healthy pregnant women in the first trimester, 30 in the second trimester, 31 in the third trimester, and 30 non-pregnant healthy controls were investigated. This study showed that early pregnancy may possibly be associated with significant changes in olfactory performance. They analyzed that the misrepresentation of odor recognition in the first trimester might be a contributing factor for the occurrence of pregnancy-specific conditions, such as morning sickness and hyperemesis gravidarum, which are both joint complaints throughout the initial stage of parturition.<sup>[19]</sup> Others revealed that, during early pregnancy, olfactory dysfunction has an insignificant effect on nausea and vomiting.<sup>[20]</sup> In another study, the pregnant women rated their particular smell sense truncated.<sup>[21]</sup> 76% of the pregnant women reported unusual smell and/or taste sensitivity. Increased smell sensitivity was found in 67% of all pregnant respondents at early pregnancy and occasionally 17% of them associated with qualitative smell alterations, and 14% of them with phantom smells. The smell anomalies were found less common at late pregnancy and nearly absent during the postpartum stage.<sup>[22]</sup> 90% of pregnant women stated that some odors were sensed less pleasing. These and earlier results may reveal that the pregnancy's effect on olfaction is minor and varying.<sup>[23]</sup>

In a research, pregnant women had significantly lower gustatory sensitivity scores. Besides, pregnant women rated the odors 'rum', 'cigarette' and 'coffee' as extra aversive than non-pregnant women. Kölblle et al. reported that pregnant women had a reduced odor threshold when compared to non-pregnant women. Six weeks after birth, this variance was still present. The link between olfactory and limbic systems during pregnancy may trigger this effect.<sup>[24]</sup>

Ochsenbein-Kölblle evaluated the olfactory function of pregnant women at about 12, 21, and 36 weeks of gestation and postpartum 7 weeks. There was no difference in olfactory function between the control cases and the pregnant women in the first trimester. Nevertheless, the pregnant women suffered a reduced odor threshold compared

to the non-pregnant controls at about 36 weeks of gestation. Pregnant women have evaluated olfactory sense higher than the control cases. Hormonal, cognitive, and metabolic factors may cause transform in the discernment of odors throughout the pregnancy. Pregnant women have cardiovascular, respiratory, renal, hematologic, and endocrine variations. These variations affect olfactory perception in different ways. The olfactory threshold is reduced during pregnancy.<sup>[25]</sup>

### The Embryo Protective Hypothesis

Numerous pregnant women remark changes in taste and smell which may be called as "morning sickness".<sup>[26]</sup> Bitter perceptions and strong odors are frequently signals of advanced toxic resistances in floras. These may be detoxified or processed without injury in the adults. However, they are harmful for the embryo in even insignificant quantities. Variations in olfactory discernment would take action as a mechanism to amplify maternal prevention of toxins. Pregnancy sickness occurs in early pregnancy just when the embryo is utmost defenseless to maternally consumed toxins.<sup>[21]</sup>

### Conclusion

In pregnant women, olfactory dysfunction was observed in all trimesters. It was low in the second trimester and higher in the first and third trimesters. The smell abnormalities were almost absent at postpartum period. As olfactory functions improved after delivery of the baby, olfactory chances during pregnancy may be accepted as physiological changes which were observed in many pregnant women.

**Conflict of Interest:** No conflicts declared.

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